Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/CA05/000209

International filing date: 18 February 2005 (18.02.2005)

Document type: Certified copy of priority document

Document details: Country/Office: US
Number: 60/644,010
Filing date: 18 January 2005 (18.01.2005)

Date of receipt at the International Bureau: 13 July 2005 (13.07.2005)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)

World Intellectual Property Organization (WIPO) - Geneva, Switzerland
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APPLICATION NUMBER: *60/644,010*
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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

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INVENTOR(S)

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Additional inventors are being named on the second *separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max):

DISC VALVE SYSTEM

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

☑ The address corresponding to Customer Number: 25545

OR

☐ Firm or Individual Name

Address		
City	State	Zip
Country	Telephone	Fax

ENCLOSED APPLICATION PARTS *(check all that apply)*

☐ Application Data Sheet. See 37 CFR 1.76

☑ Specification *Number of Pages* 15

☑ Drawing(s) *Number of Sheets* 17

☐ CD(s), Number of CDs ______

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Application Size Fee: *If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).*

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SIGNATURE ______ Date January 18, 2005

TYPED or PRINTED NAME Alain M. Leclerc

REGISTRATION NO. 37 036
(if appropriate)

TELEPHONE 514-397-7675

Docket Number: TV/14068.3

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PROVISIONAL APPLICATION COVER SHEET
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First Named Inventor	Fotis Agapiades	Docket Number	TV/14068.4

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Number 2 of 2

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TITLE OF THE INVENTION

DISC VALVE SYSTEM

FIELD OF THE INVENTION

The present invention relates to disc valve system . More specifically, the present invention is concerned with disc valve system for a piston driven internal combustion engine.

BRIEF DESCRIPTION OF THE DRAWINGS

In the appended drawings where like elements are referenced by like reference numerals and in which:

Figure 1 is a perspective view of the disc valve system in accordance with an embodiment of the invention;

Figure 2 is a front elevational view of the disc valve system of Figure 1;

Figure 3 is a front elevational view of the disc valve system in accordance with another embodiment of the present invention;

Figure 4 is a front elevational view of the disc valve system in accordance with an embodiment of the invention;

Figure 5 is a front elevational view of the disc valve system in accordance with an embodiment of the invention;

Figure 6 is a sectional view taken along line 66 of Figure 1;

Figure 6B is a sectional view similar to Figure 6 in accordance with another embodiment of the invention;

Figure 7 is a lateral view of the disc valve system mounted onto an engine in accordance with an embodiment of the invention;

Figures 8 and 9 are top sectional views of the cylinder head manifold;

Figure 10 is a bottom perspective view of the rotating disc in accordance with an embodiment of the invention;

Figure 11 is a top perspective view of the disc of Figure 10;

Figure 12 is a bottom plan view of a disc in accordance with an embodiment of the invention;

Figure 13 is a bottom plan view of a disc in accordance with another embodiment of the invention;

Figures 14 and 15 are bottom plan views of a disc in accordance with a further embodiment of the present invention;

Figure 16 is a top perspective view of a disc in accordance with yet another embodiment of the invention;

Figure 17 is a bottom plan view of a disc in accordance with yet a further embodiment of the invention;

Figure 18 is a lateral view of the top timing gear of the disc valve system in accordance with an embodiment of the invention;

Figure 19 is a perspective view of a ring seal and the top of a piston cylinder in accordance with an embodiment of the invention;

Figure 20 is a perspective view of an intermediate ring seal in accordance with another embodiment of the invention as well as a piston cylinder, in accordance with another embodiment of the present invention;

Figures 21 and 22 are schematic views of the tension system for the chain, in accordance with an embodiment of the present invention; and

Figure 23 is a front view of a disc valve system in accordance with an embodiment of the invention.

DESCRIPTION OF EMBODIMENTS

With reference to the appended drawings, embodiments of the invention will be herein described so as to exemplify the invention and not limit its scope.

FIG. 1 shows the disc valve system 10 in accordance with an embodiment of the invention.

Disc valve system 10 is to be mounted on an engine E (as shown in Figure 7) and includes a rotating disc 12 mounted between a cylinder head manifold 14 and an engine cylinder 16, which defines a combustion chamber 154 (see Figures 19 and 20) that contains a piston head 17 (as shown in Figure 2 for example). A connecting rod 18, mounted to the piston head 17, descends from the engine cylinder 16 and is mounted to the crankshaft 20.

In this way, a bottom sprocket gear 22, which is fixedly attached to the crankshaft 10, is caused to rotate in bearings 24 by the engine piston 16 acting through the connecting rod 18 in the general matter of a four-bar slider mechanism. The rotation of the bottom sprocket gear 22 is transmitted to a top sprocket gear 26 via a chain 28 mounted to both the bottom and top sprocket gears 22 and 26. The top sprocket gear 26 is fixedly attached to the shaft 30 of a bevel pinion gear 32. The bevel pinion gear 32 includes bevel teeth 34 which are meshed with bevel teeth 36 of rotating disc 12.

FIG. 2 is similar to FIG. 1 except that the cylinder head manifold 14 and engine cylinder have been removed. As shown in FIG. 2, the disc 12 comprises a top portion 38 and a bottom portion 40. The bottom portion 40 comprises the bevel teeth 36 and a sealing portion 42 including a sleeve 44. With reference to Figure 6, sleeve 44 covers the top portion of the engine cylinder 16. Flexible seals 45 are positioned between the disc 12 and the engine cylinder 16. Turning back to Figure 2, the top portion 38 comprises a top sealing surface 46 as well as a central tubular shaft 48. As shown in FIG. 6, the shaft 48 is rotatably mounted in the cylinder head manifold 14 and the top sealing surfaces 46 are in slidable contact with this cylinder head manifold 14. Flexible

seals 49 are placed between the disc 12 and the cylinder head 14. Turning back to FIG. 2 and with reference to Figure 6, a spark plug 50 is mounted to the tubular shaft 48.

With reference to Figures 2, 4, 5, 19 and 20, an intermediate ring seal 15 is positioned between the disc 12 and the engine cylinder 16.

FIG. 3 shows the disc valve system 52, in accordance with another embodiment thereof. Only the features, which are different from the embodiment described in FIGS. 1 and 2, will be described herein for concision purposes. In the disc valve system 52, the engine valve train components for transferring the movement of the crankshaft 20 to the movement of disc 12 include a bottom pinion gear 54 that is fixedly mounted to the crankshaft 20; this bottom pinion gear 54 includes bevel teeth 56, which are meshed with the bevel teeth 58 of the bottom gear 60, which is mounted at the bottom end of a rotating rod 62. The rotating rod 62 includes at its top end a top bevel pinion gear 64, whose bevel teeth 66 are meshed with bevel teeth 68 of a top double bevel pinion gear 70. This top double bevel pinion gear 70 includes two opposite faces, each having respective bevel teeth 68 and 72. Bevel teeth 72 are meshed with the teeth 36 of disc 12.

In this way, the movement of crankshaft 20 is transferred to disc 12 via rod 62 being acted upon by bottom pinion gear 54, which acts on double pinion gear 72, which in turn acts on disc 12.

FIGS. 1, 4, 5, 6, 7, 8, and 9 show the cylinder head manifold 14 including an intake conduit 74 leading to an intake port 76 and an outtake conduit 78 leading to an outtake port 80.

FIGS. 10, 11, 12, 13, 14, 15, 16, and 17 illustrate a variety of embodiments of the rotating disc, in accordance with the present invention.

FIGS. 10 and 11 show rotating disc 82. FIG. 10 shows rotating disc 82 having a bottom face 40. This bottom face includes bevel teeth 36, a central aperture 84, and sequencing ports 86 and 88. The disc 82 also includes a circular intrusion 92 that is mated with the cylinder box 93 as shown in Figure 6B.

FIG. 11 shows a top face 38 of disc 82 showing the central aperture 84 as well as the two sequencing ports 86 and 88, which are spaced about the axial centre of rotation. Furthermore, the disc 82 includes a circular ridge 90 that mates with the cylinder head manifold 14, as shown in FIG. 6B.

With reference to FIG. 6B, the disc 82 is shown to have a circular groove 92, which is a slidable relationship to a circular protrusion 93 of the cylinder box 94. The underside 96 of cylinder head 14 has an anti-friction material 98 that is added thereon by a variety of methods and whose shape is configured to be complementary to the top face 38 of disc 82 in such a way as to allow slidable mating between disc 82 and cylinder head 14. In the embodiment shown in FIG. 6B, the spark plug 50 are directly mounted onto the cylinder head 14 and in this way do not rotate with the disc 82.

FIG. 12 shows another embodiment of a rotatable disc 98 which has bevel teeth 100 around its periphery of its underside, as well as a central aperture 102 and two sequencing port apertures 104 and 106 respectively, which are on the same rotational orbit.

FIG. 13 shows a further embodiment of a disc 108, which is similar to the disc 98 described above, yet, in this case, the two sequencing ports 110 and 112 are in different rotating orbits. In this way intake and outtake can be independently regulated as if there were two rotating discs.

Figures 14 and 15 show a rotatable disc 114 in accordance with another embodiment of the invention. Again, this disc 114 includes bevel teeth 36 on its underside 40, and ports 116 and 118. The ports 116 and 118 include respective shutters 120 and 122, which are biased towards a substantially closed position, as shown in Figure 14, making the aperture defined by ports 116 and 118 smaller via a biasing member 124 in the form of a tension spring. As shown in Figure 15, during rotation in the direction shown by arrow R, the shutters 120 and 122, move towards the external periphery of disc 114, as shown by arrows I and II, via a centrifuge action that is dependent on the speed of rotation and such increasing the size of ports 116 and 118. As the rotation of the disc slows down, this centrifuge action will decrease and the biasing force of the tension spring 124 will move the shutters 120 and 122 towards the centre of the disc, hence decreasing the size of ports 116 and 118.

FIG. 16 shows the top portion 38 of a rotatable disc 128, in accordance with an embodiment of the invention. The disc includes two ports 130 and 132. These ports also have shutters in the form of flaps 134 and 136 respectively. These flaps 134 and 136 are mounted to respective biasing members 138 in the form of a coil, which bias the flaps 134, and 136 in the closed position shown here in dotted line. As the disc 128 rotates in the direction shown by arrow RI, the flaps 134 and 136 will move away from ports 130 and 132 due to the centrifugal action, hence increasingly opening ports 130 and 132 as the speed of rotation increases and increasingly closing these ports 130, 132 as the speed of rotation decreases.

FIG. 17 shows disc 140, in accordance with another embodiment of the invention. Disc includes bevel teeth 36 at its underside 40, a central aperture 84, and a series of ports decreasing in size as they move from the external periphery of the disc 140 towards the centre. These ports are symmetrical with respect to central aperture 84. As shown, there are four ports 142, 144, 146, and 148, at one side of aperture 84, and another four ports 143, 145, 147, and 149, at the other side of central aperture 84. As shown, the following pairs of ports 142 and 143, 144 and 145, 146 and 147, 148 and 149 are mirror images of each other and at an equal distance from the central aperture 84. Hence, intake and outtake can be regulated by varying the rotational speed of the disc. In this way the smaller ports are either given enough time for proper intake or outtake or prevented from doing so.

FIG. 18 shows the top sprocket gear 26 and includes a hub 27, which holds a resilient member 29 as well as external teeth 25

on which chain 28 is mounted to. The sprocket gear 26 functions as a timing gear for the disc valve system 10. This timing gear 26 has a hub 27 that is aligned concentrically about the axis of rotation of gear 26. The hub 27 holds a resilient member 29 that is fixedly secured by a plurality of matching interfacing sector contours configured in this resilient member 29, and that is correspondingly contoured in the hub 27. The timing gear 26 is rotatably mounted on the timing shaft 30. As mentioned above, the timing shaft 30 comprises bevel gear 32 fixedly attached to one end thereof. The resilient member 29 can be made by a variety of synthetic rubbers. This hub 27 with the resilient member 29 serve a flexible coupling between the gear 26 and the shaft 30. This flexible coupling is used to provide a shaft to work flexibly under heavy starting loads or to offset a shaft misalignment. The resilient member 29 provides a means for lowering big friction loads at the sliding interface between the stationary stator surface and the surface of the rotating disc 12 operating within the fluctuating pressure field of the engine combustion chamber 154. Rotation of the disc 12 within the engine combustion chamber 154 periodically opens and closes a plurality of exhaust and intake ports in the stationary stator of the engine cylinder head 14 in a sequential manner corresponding to the alternating order of the engine through one or more dynamic pressure cycles. The flexible coupling between the timing gear 26 and the timing shaft 30 momentarily slows the rotational velocity of the disc 12 during the highest peak pressure of the engine combustion stroke at the point of the ignition spike thereby reducing the sliding contact frictional energy between the disc 12 and the stator surfaces. which is exponentially at its highest point during this brief period. At the few milliseconds of peak combustion pressure, ignition spike the resilient

member 29 between the hub 27 of the timing gear 26 and the timing shaft 30 is slightly compressed causing the timing shaft 30 to rotate slower than the timing gear 26 for a brief instant over a small millisecond increment of a rotation and thereby transmitting a slowing motion to the disc 12 rotation. This slowing motion is hardly measurable but at the molecular interface of the lubricating film between the surfaces and slidable contact, the shearing impact across the interface is lessened exponentially as a function of the contact and velocity. Absorption of peak torque loads on the timing shaft by the resilient member 29 during the peak combustion pressures when the sliding contact friction between the disc 12 and the stator are highest, will lessen wear between the two surfaces and lower the potential for galling. The resilient member 29 is an elastic material capable of fully responding over the engine operating frequency. Formulation of rubber resilient members with extenders or catalyst accelerators will stiffen the response in a manner that permits full recovery after each compression and will not couple with the engine's natural frequency. The resilient member 29 may be manufactured from any material that has the physical properties of sustained response of rapid compression loads with rapid recovery and good storage durability with long-term fatigue capability under heavy loads.

FIGS. 19 and 20 show intermediate ring seals 15 and 150 respectively which is used to effectively seal the combustion chamber 154 defined by the engine cylinder 16 by forming a dynamic sliding seal with the rotating disc 12 and a static seal with the engine cylinder 16 within the limiting axial distance of the combustion volume when the engine piston 17 is at top dead centre at the end of its

compression stroke. This sealing is achieved by the sleeve 44 which extends from the underside 40 of disc 12 and extends over the engine cylinder 16, as clearly shown in FIG. 1, for example, and as such, allowing for an intervening space for the intermediate ring 15 or 150 to seal against the engine cylinder 16. Both ring members 15 and 150 are machined on the outer perimeter to hold a stationary seal 156. At the bottom edge of the ring seal, there is a recess formed. Ring seal 15 includes an inclined recess 158 whereas disc 150 includes a straight recess 160. Recesses 158 and 160 are formed to accept pins 162 and 164, as shown in FIGS. 19 and 20 respectively near the outer perimeter of cylinder 16 for holding the intermediate ring seals 15 and 150 in place and preventing their rotation. The top portion 166 of both ring seals 15 and 150 are in a dynamic seal with the disc 12 hence, allowing the disc 12 to rotate with respect to the ring members 15 or 150. The bottom portion 168 of ring seal 15 or 150 is in a static stationary seal. The top internal periphery 170 of the piston cylinder 16 is recessed and forms a seating arrangement that is complementary to the bottom portion 168 of rings 15 or 150 in order for these rings to be seated thereon in sufficient fit.

FIGS. 21 and 22 show a tension system 172 that is used on chain 28, which acts on the bottom and top sprocket gears 22 and 26. This tension system 172 includes first and second tension elements 174 and 176 which are linked together via a dynamic member 178 such as a rod, a spring, an elliptical ring, or by solid rod and in this case the tension elements 174 and 176 are mounted to the cylinder box 93 via spring members (not shown). The tensions elements 174 and 176 may also be mounted via flexible resilient members to the

dynamic member 178. When the chain 28 is in movement it will act on the tensions system 172. One side 29 of the chain 28 will act on tension element 174 which will push chain side 29 inwards as shown by arrow A, the dynamic member 178 will push tension element 176 outside in the same direction as shown by A'. The foregoing will cause the dynamic member 178 or the resilient members mounted to tension elements 174 and 176, via an equal and opposite reaction to the movement represented by arrows A and A', to act on tension element 176 to push side 31 of the chain 28 inwardly as shown by arrow B, simultaneously the dynamic member 178 will push the tension element 174 outside in the same direction as shown by arrow B'. This reciprocating movement represent by arrows A, A' and B, B' causes the top gear 26 to slow down or rotate in a non-constant speed, which has the same effect on the disc 12, hence slowing down a given intake or outtake port on the disc 12 from meeting its complementary outtake or intake aperture on a cylinder head 14, in such a way as to cause a non-uniform sequencing by causing this periodic tension on the chain 28.

Figure 23 shows a disc valve system 100 which includes a plurality of discs 12 for respective cylinder heads (not shown). The disc valve system 100 includes a crankshaft 20 on which are rotatably mounted multiple piston heads 17 via connecting rods 18. The engine cylinders 16 and combustion chambers 154 they define are not shown. The crankshaft 20 includes at least 2 bottom sprocket gears 22 that rotate within bearings 24 to act on chains 28. Each chain 28 is connected to a rotating shaft 30 that has on one end thereof a pinion gear 26 and an opposite pinion gear 260 at another end thereof. Pinion gears 26 and 260 act on respective discs 12. In this way, the disc valve

system 100 provides for a multi piston cylinder engine to be used with the novel features of the present invention.

It is to be understood that the invention is not limited in its application to the details of construction and parts illustrated in the accompanying drawings and described hereinabove. The invention is capable of other embodiments and of being practised in various ways. It is also to be understood that the phraseology or terminology used herein is for the purpose of description and not limitation. Hence, although the present invention has been described hereinabove by way of embodiments thereof, it can be modified, without departing from the spirit, scope and nature of the subject invention as defined in the appended claims.

WHAT IS CLAIMED IS:

1. A disc valve system for a piston driven internal combustion engine, said disc valve system comprising:

a rotating disc for mounting to a cylinder head manifold and an engine cylinder, said disc comprising:

gear teeth at its inner surface;

disc ports so configured as to be brought into periodic alignment with complementary ports of an indexing stator mounted in the cylinder head manifold at cyclic intervals of the rotating movement of said disc;

an outer disc surface in communication with said cylinder head manifold, the cylinder head manifold comprising exhaust and intake ports so configured as to be brought into periodic communication with the combustion chamber of the engine during the rotating movement of said disc;

a gear assembly for being put into operative communication with said gear teeth and a crankshaft of the engine such that said disc rotates in relation to the revolution of the crankshaft; and

an intermediate ring member for sealing the combustion chamber of the engine, said ring member comprising:

a dynamic seal for being rotatatively mountable to said disc inner surface;

a stationary seal being sealed with the cylinder head sealing contact

whereby the rotating movement of said disc sequentially opens and closes each said exhaust and intake ports synergistically with the revolution of the engine crankshaft.

ABSTRACT OF THE DISCLOSURE

A disc valve system for a piston driven internal combustion engine. The disc valve system comprises a rotating disc between a cylinder head manifold and an engine cylinder. An intermediate ring member is placed between the disc and cylinder in order to seal the combustion chamber of the engine. This disc comprises ports that are to be brought into periodic alignment with complementary ports of an indexing stator mounted in the cylinder head manifold at cyclic intervals of the rotating movement of said disc. The cylinder head manifold comprising exhaust and intake ports so configured as to be brought into periodic communication with the combustion chamber of the engine during the rotating movement of the disc. A gear assembly is in communication with the disc the engine crankshaft so that the said rotates in relation to the revolution of the crankshaft. The rotating movement of the disc sequentially opens and closes each exhaust and intake ports synergistically with the revolution of the engine crankshaft.

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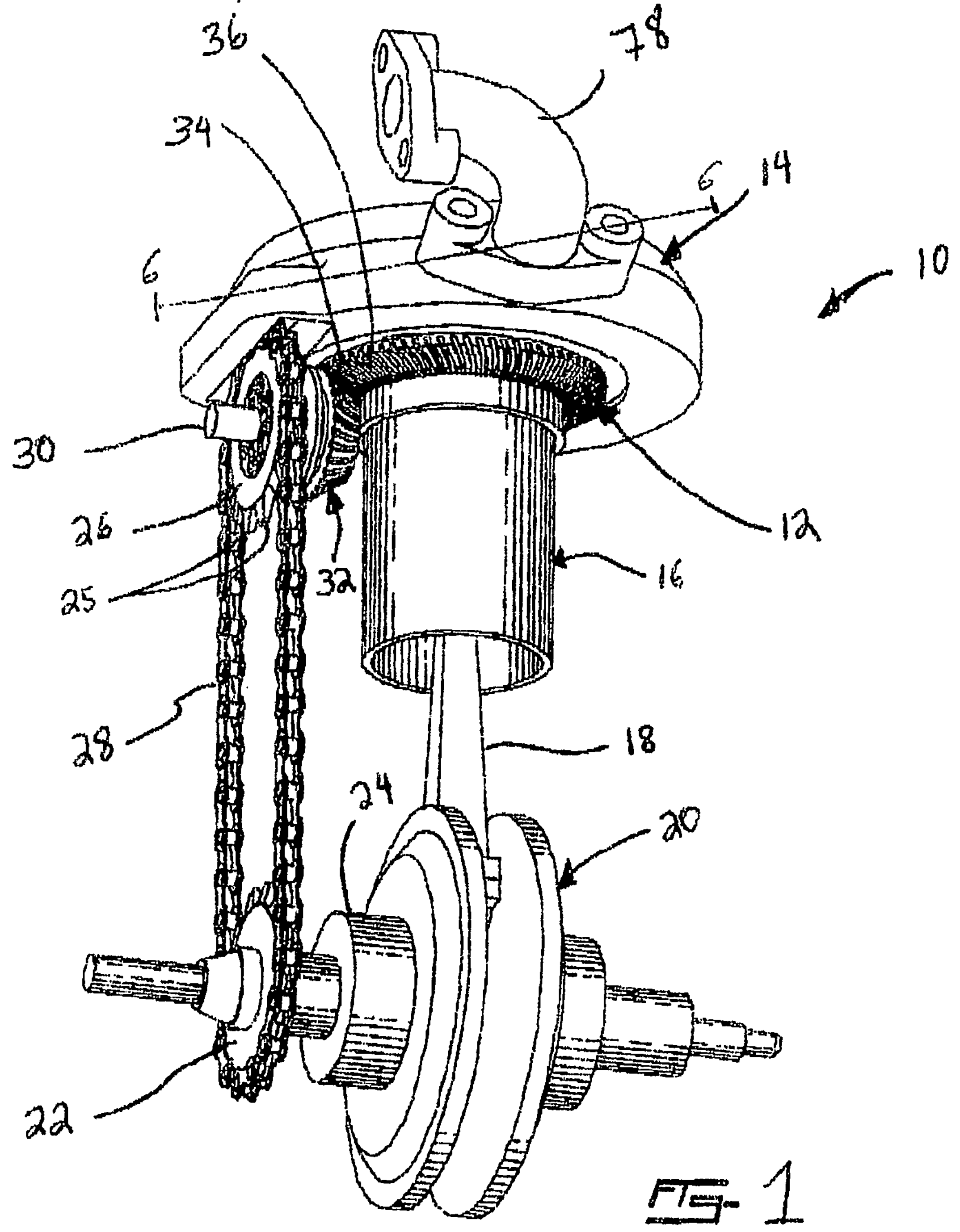

FIG-1

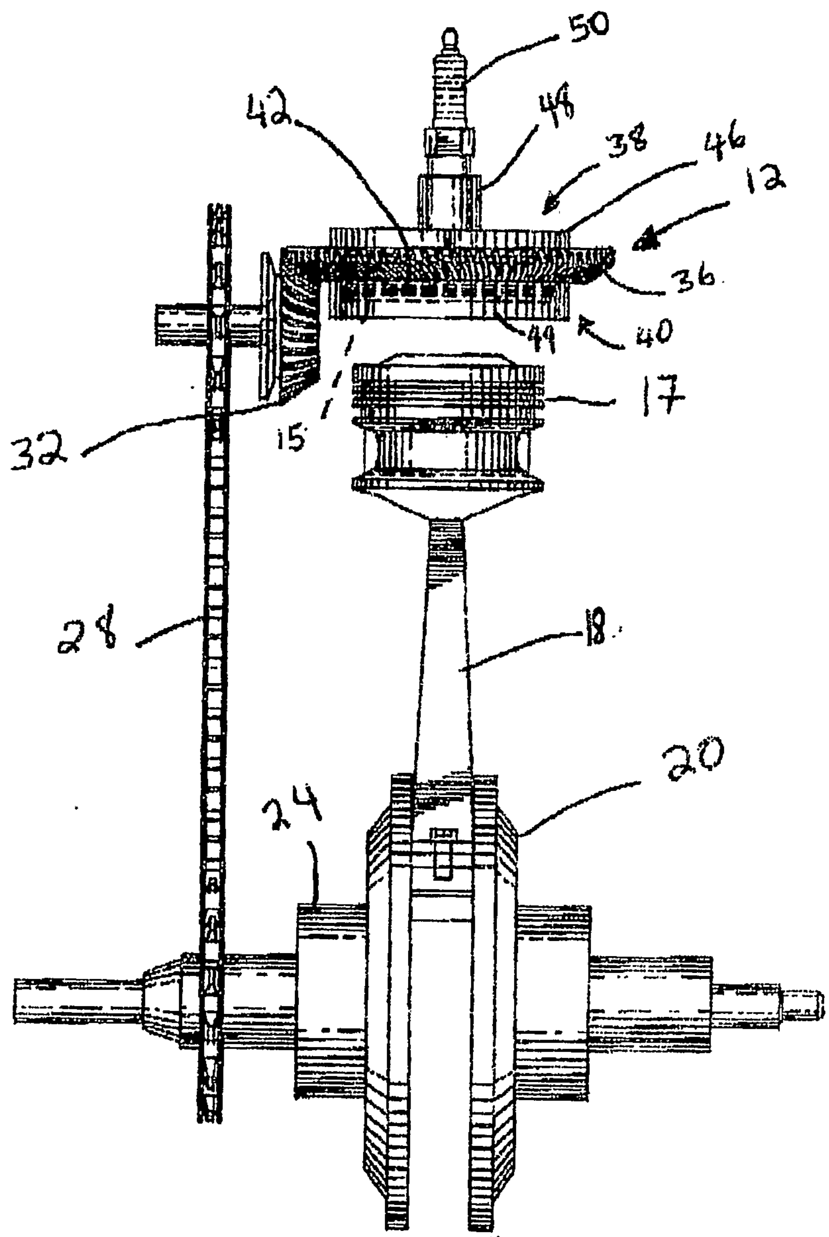

Fig- 2

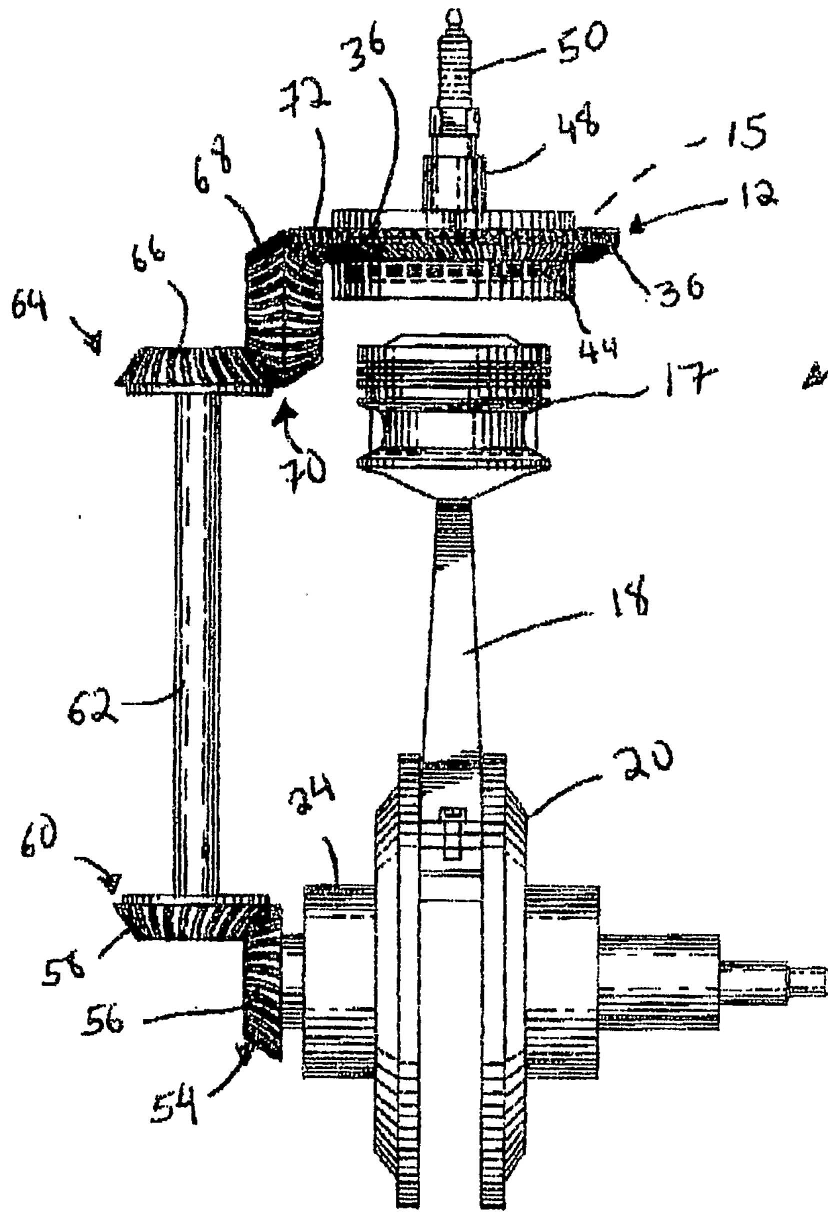

FIG. 3

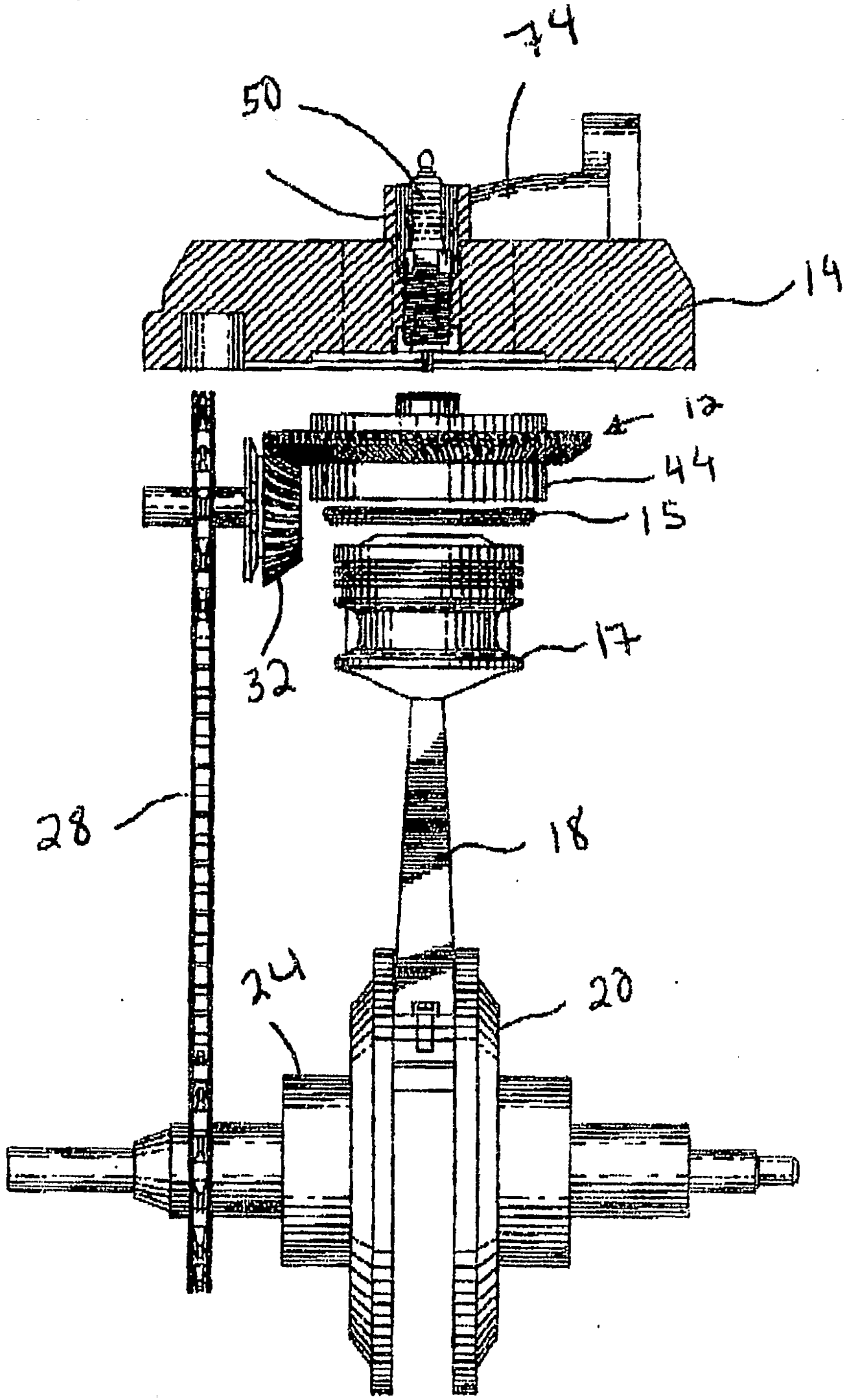

FIG- 4

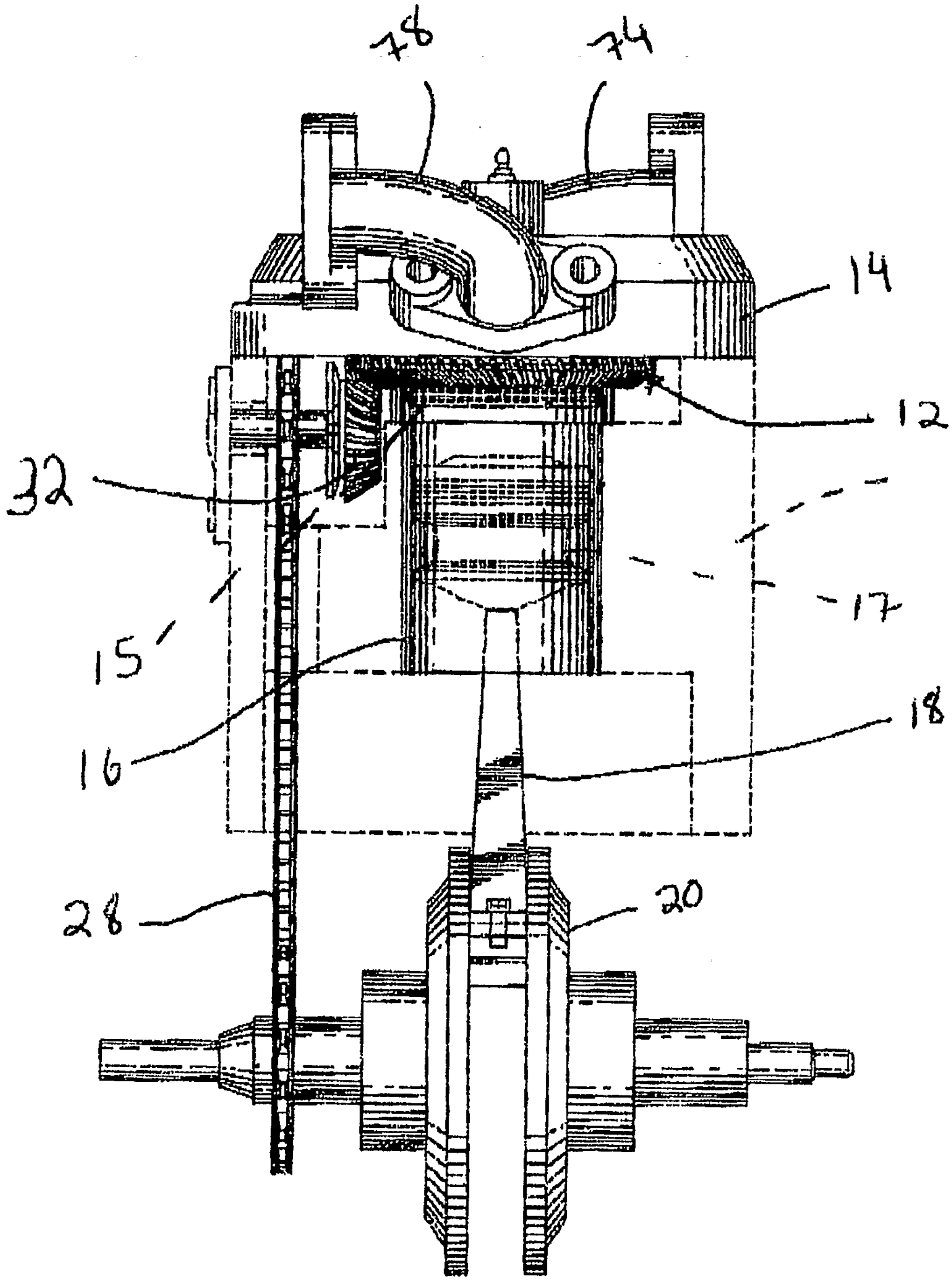

FIG-5

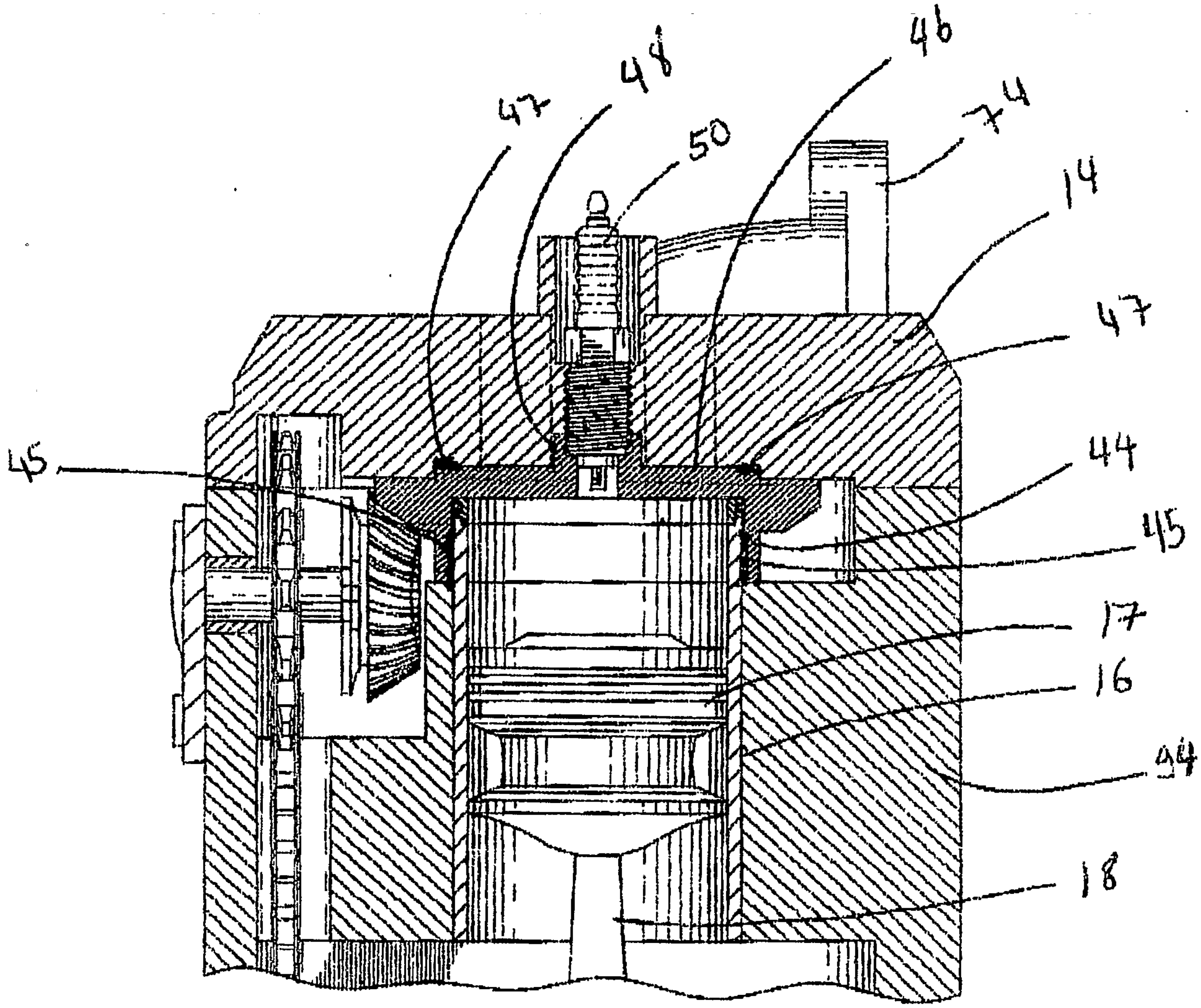

FIG-6

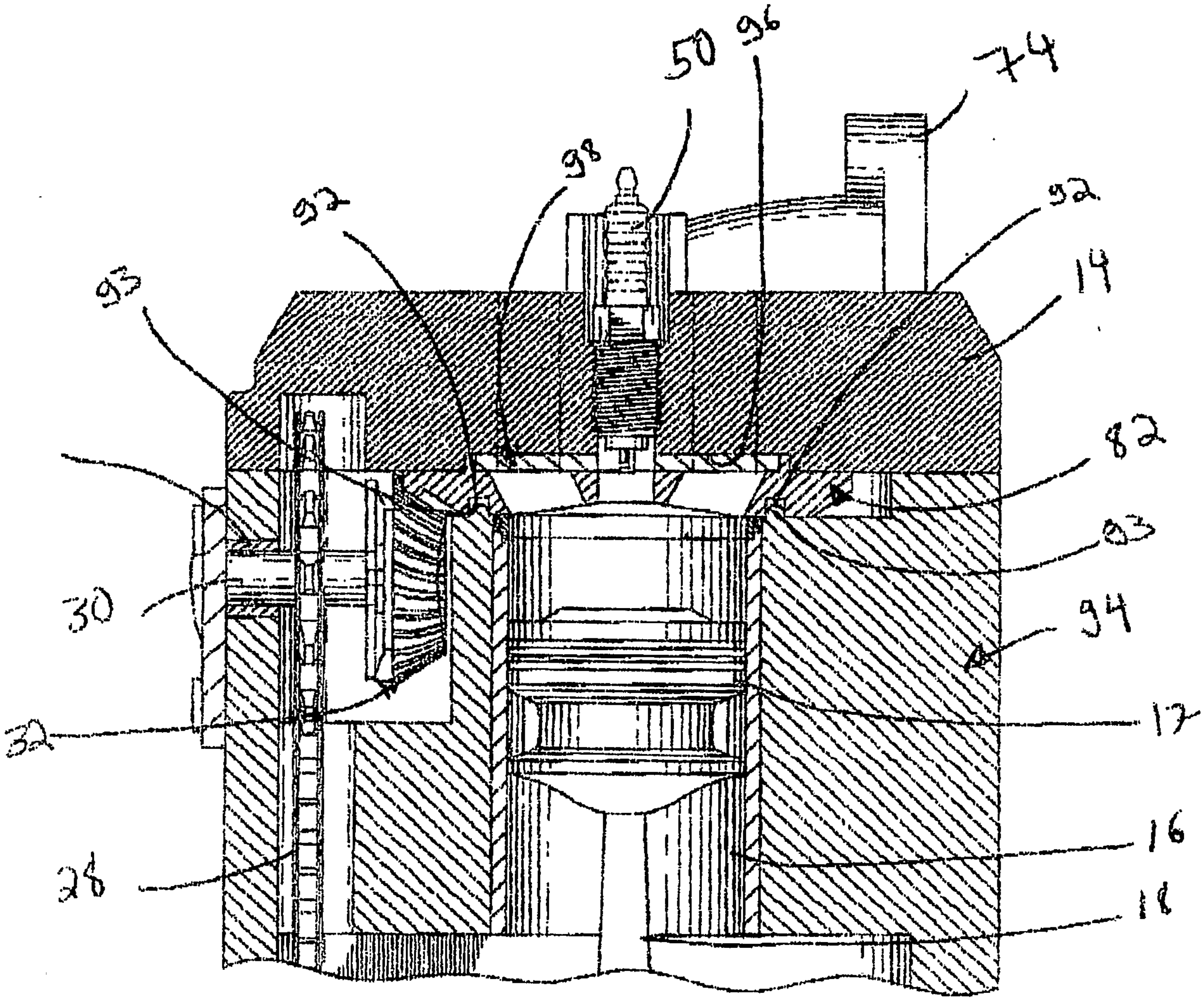

FIG. 6B

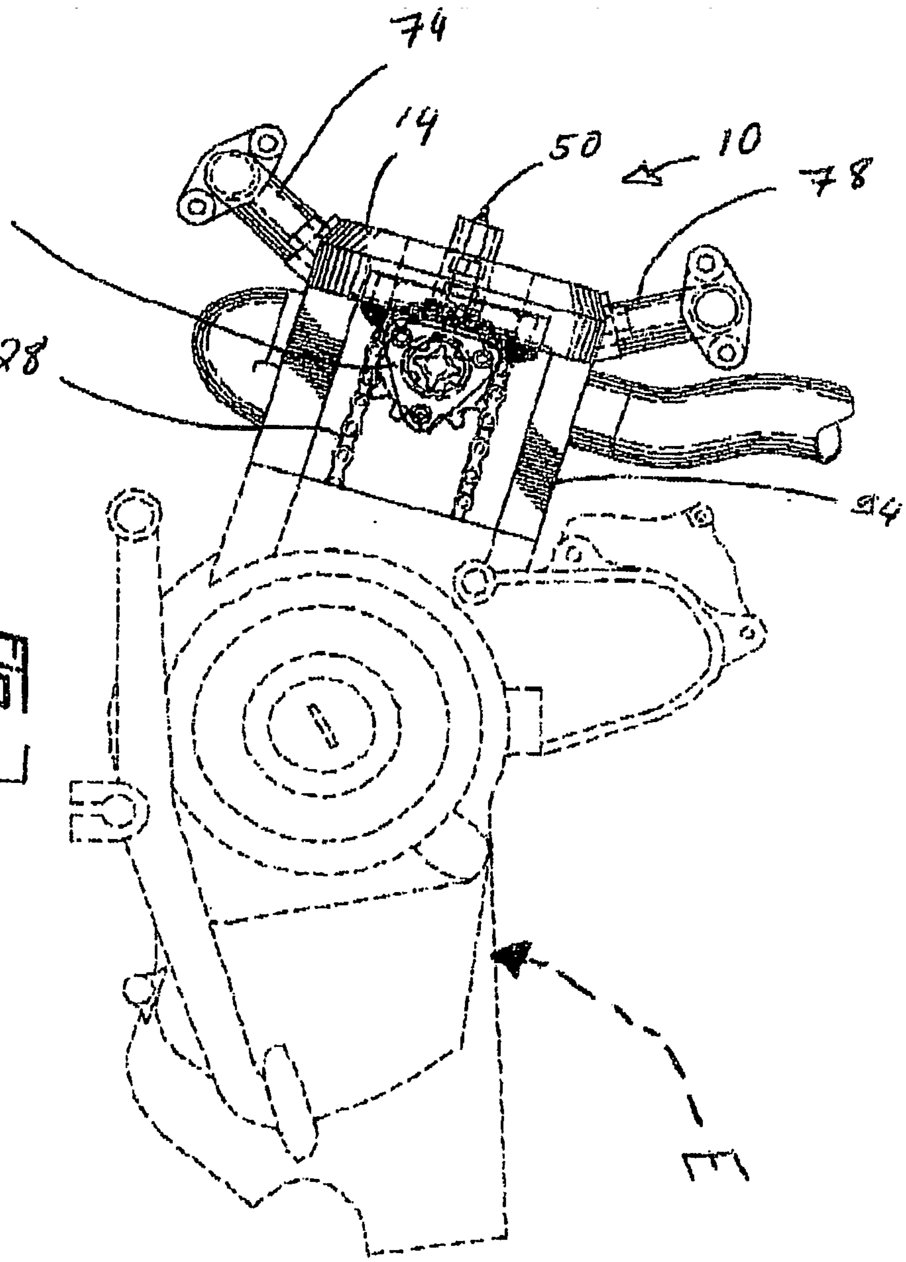

Fig 7

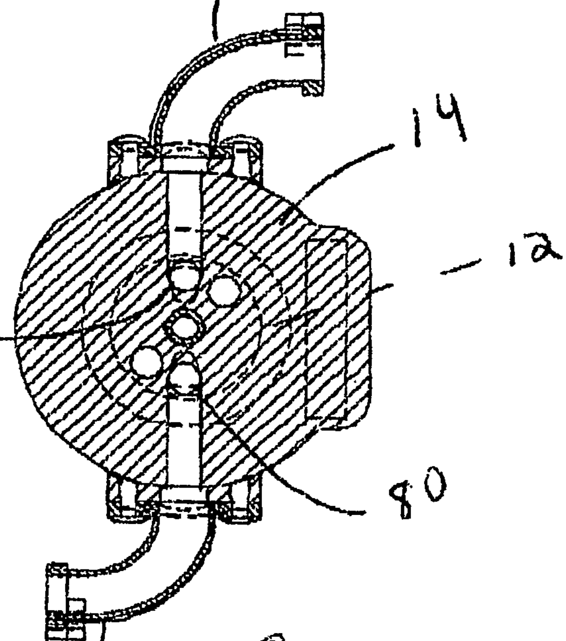

Fig. 8

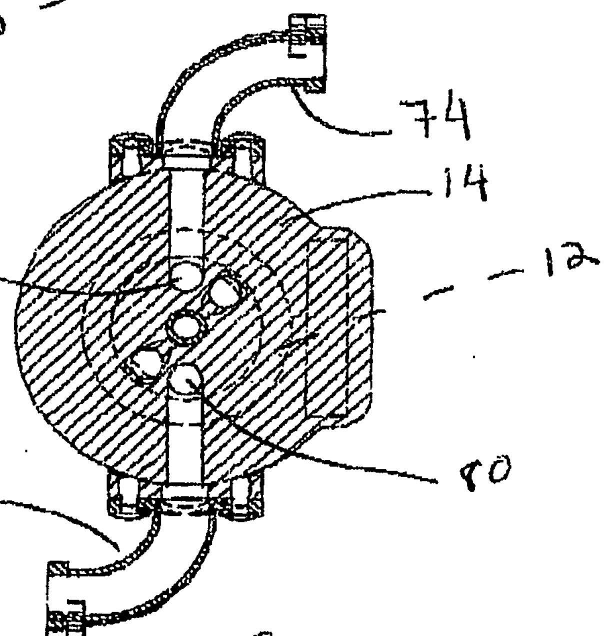

Fig. 9

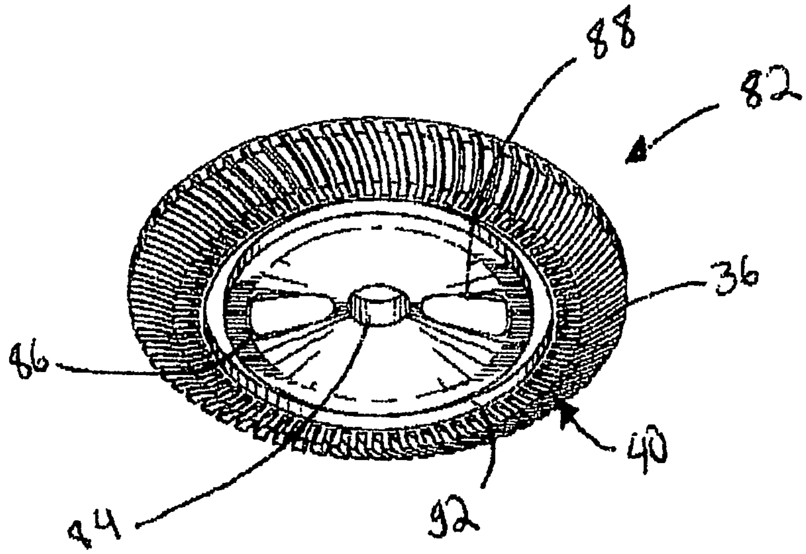

FIG- 10

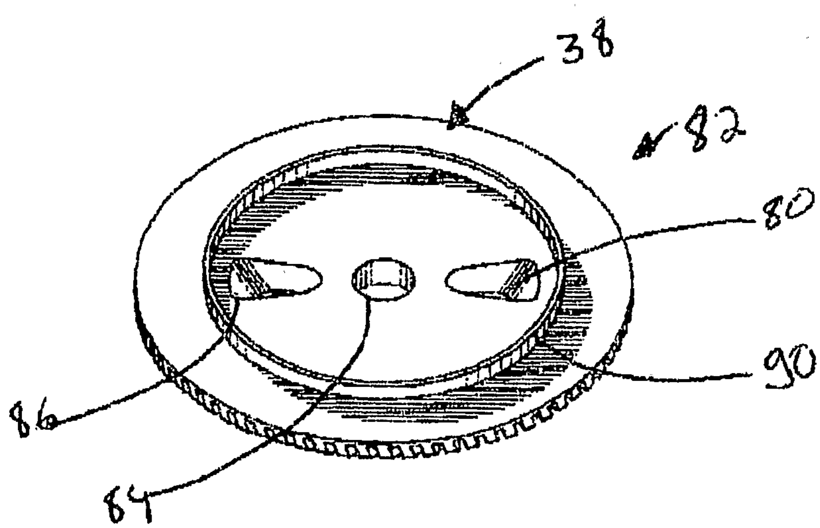

FIG- 11

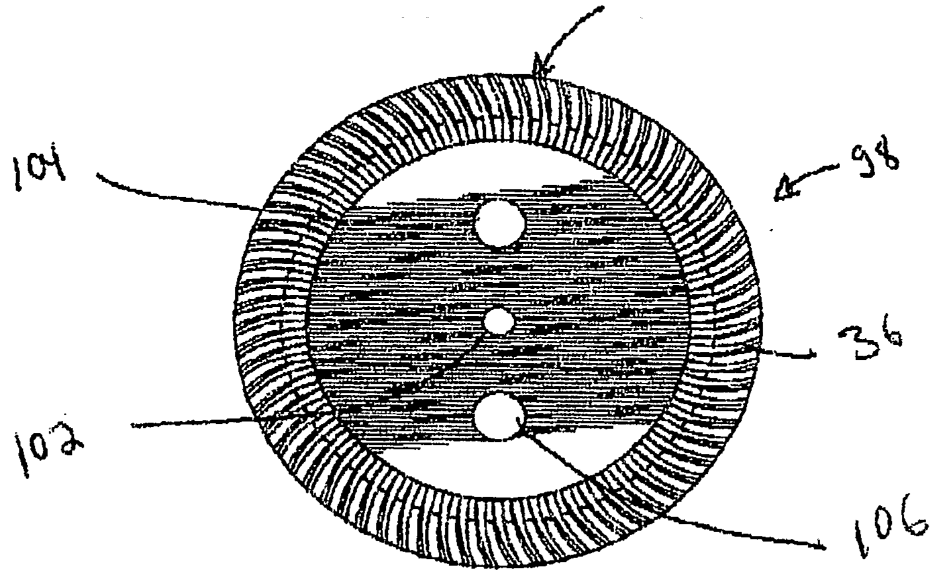

FIG. 12

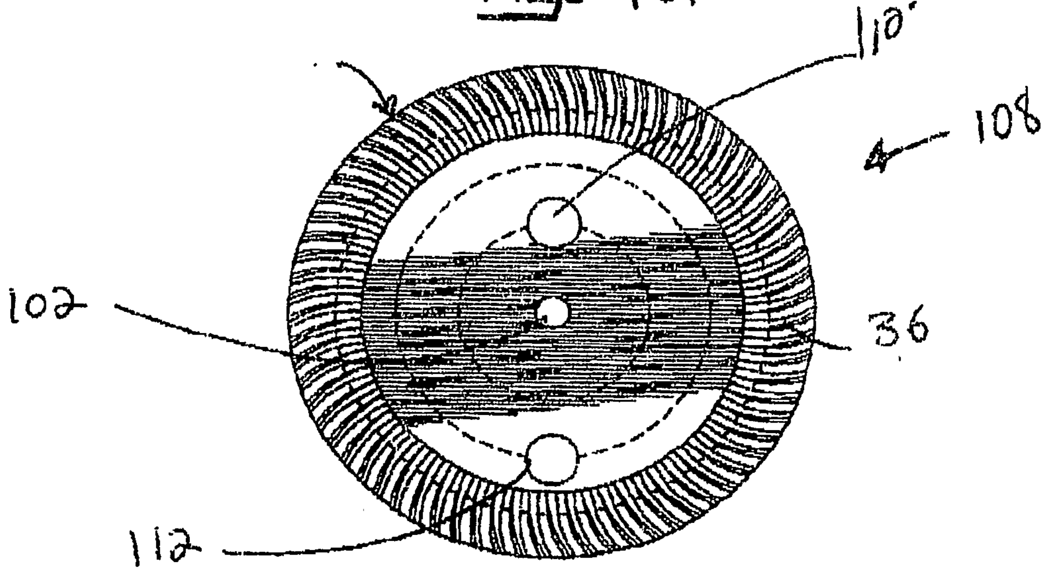

FIG. 13

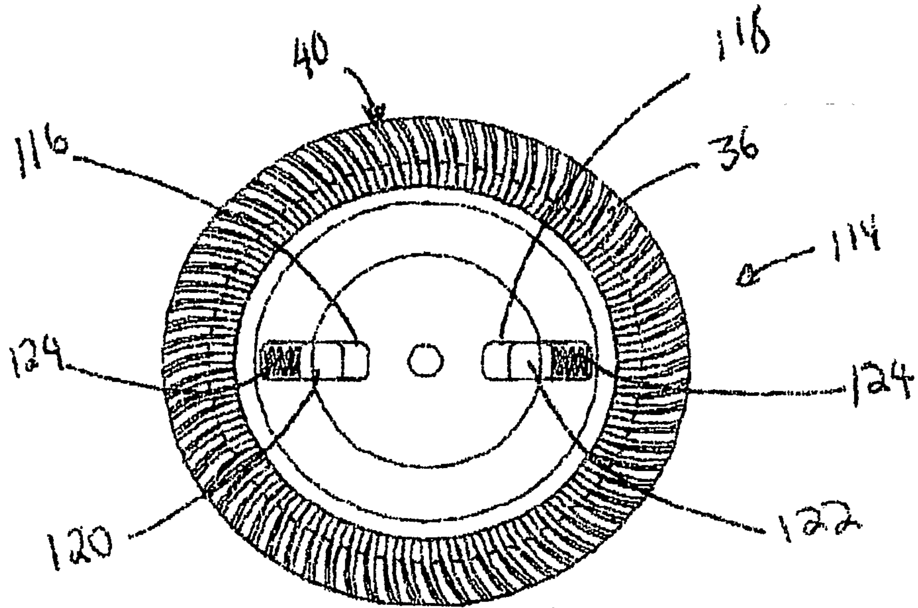

FIG. 14

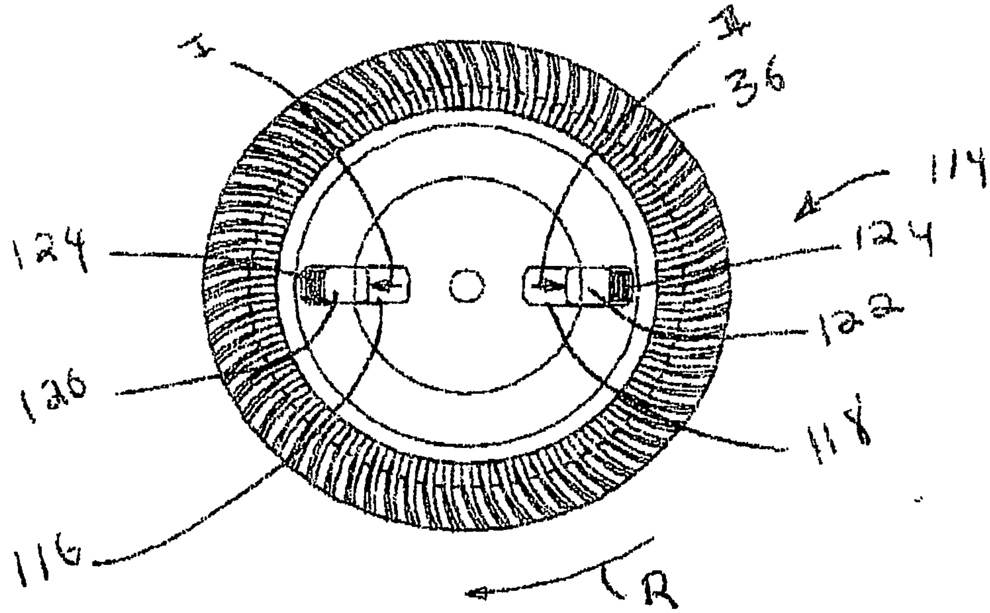

FIG. 15

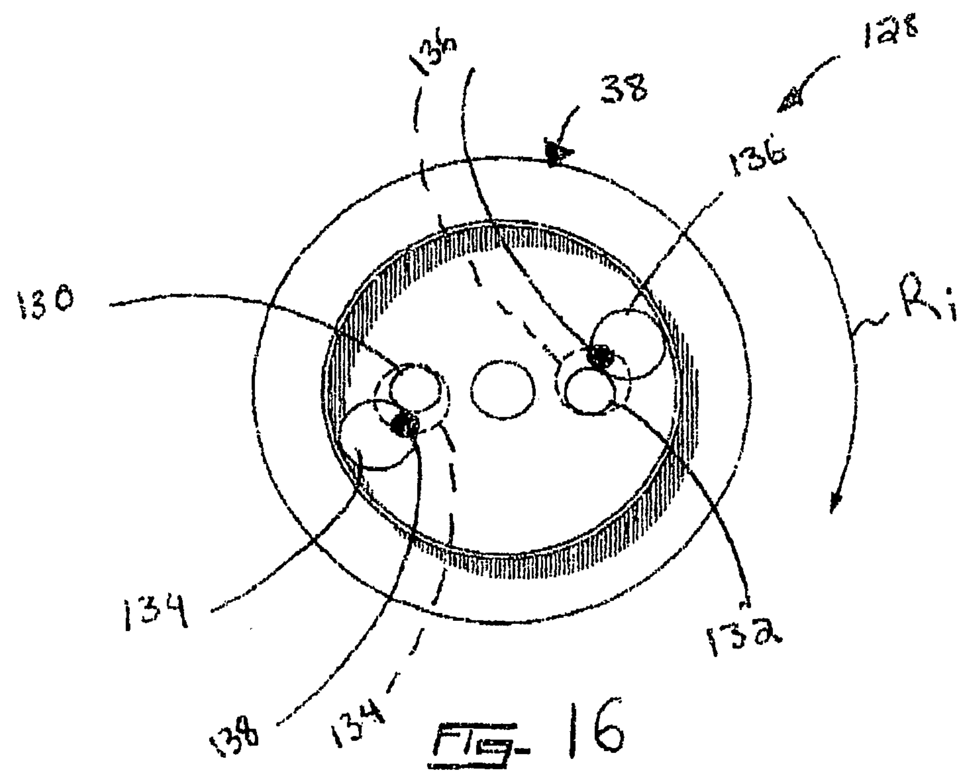

FIG- 16

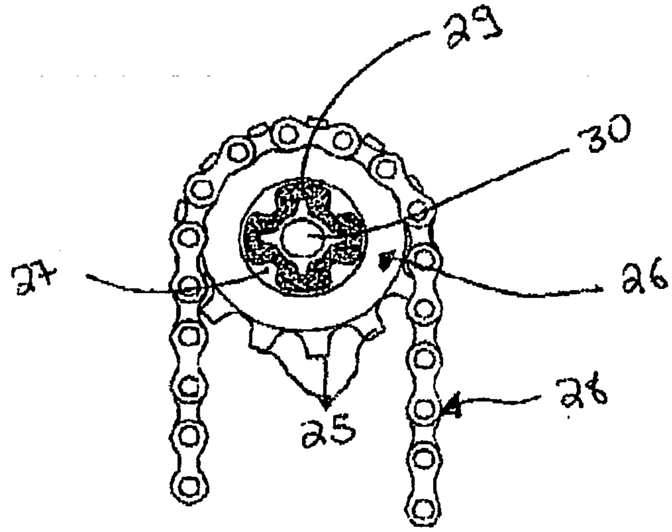

FIG. 18

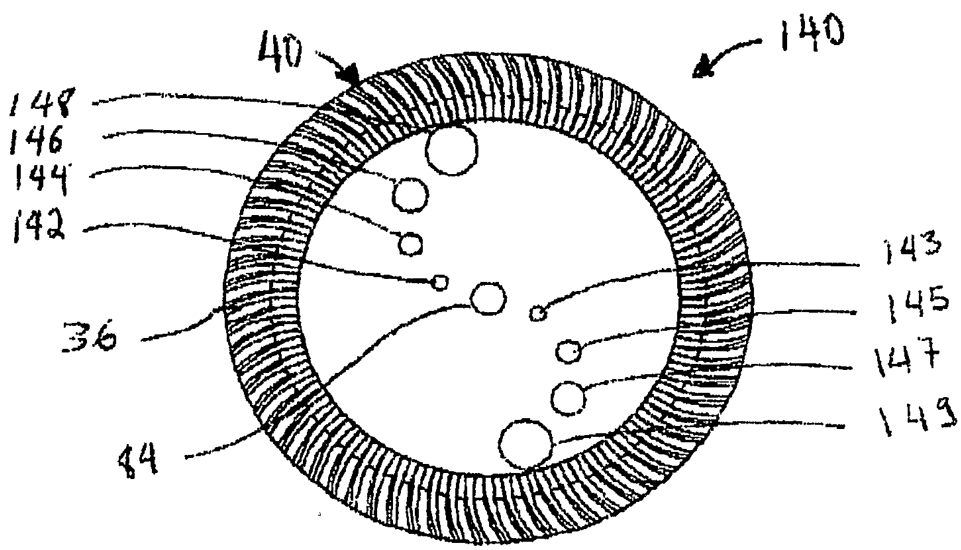

FIG. 17

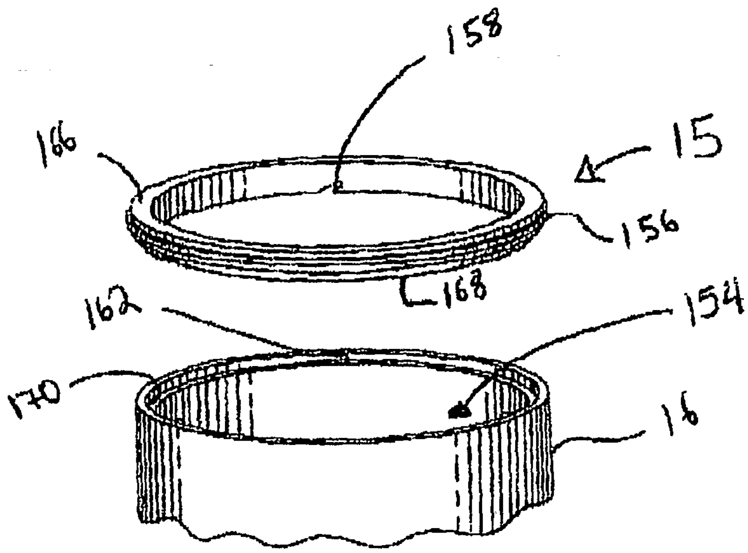
158
166
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FIG- 19

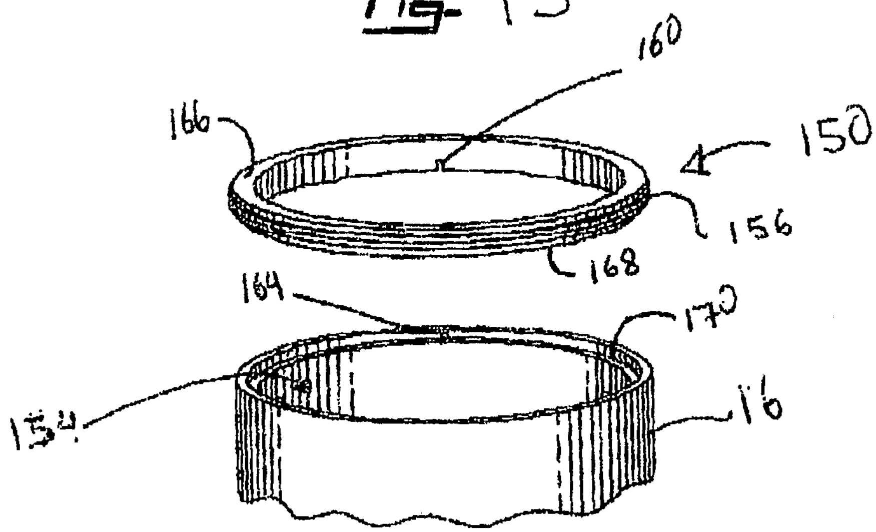
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FIG- 20

DISC VALVE TIMING SCHEME

- Engines start easier at high compression. For increased operating reliability the disc valve engine timing is designed for high compression starting at retarded intake and exhaust port openings.

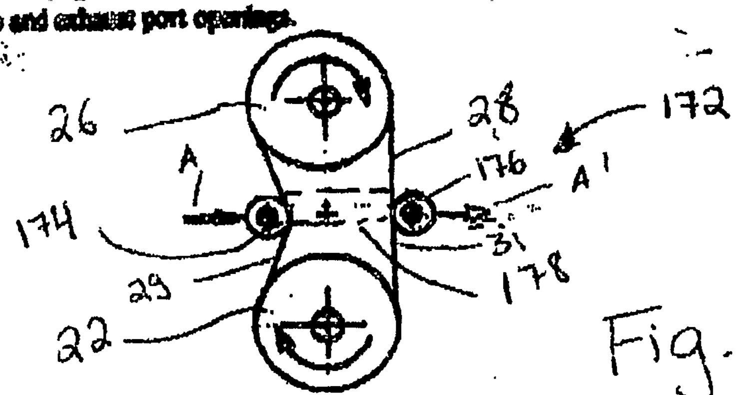
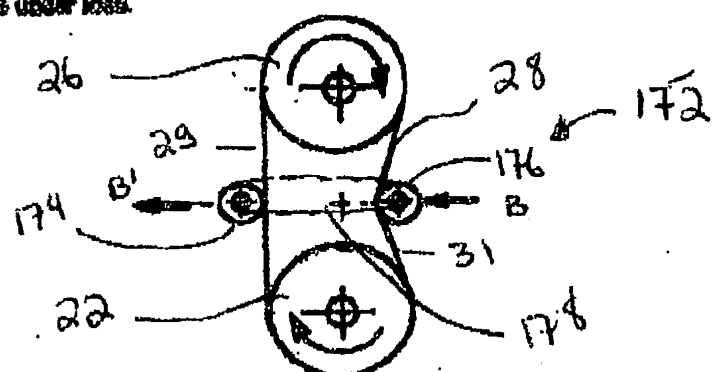


Fig. 21

Starting retarded timing position

- At high speed operation dynamic flow losses and system resistances in the manifolding circuits are alleviated by early intake and exhaust port opening increasing the engine efficiency by advancing the effective period of the power cycle under load.



High Speed Advanced Position

Fig. 22

- Valve timing improves the engine reliability and efficiency.

1. Easier starting
2. Higher operating speed
3. Increased load capacity

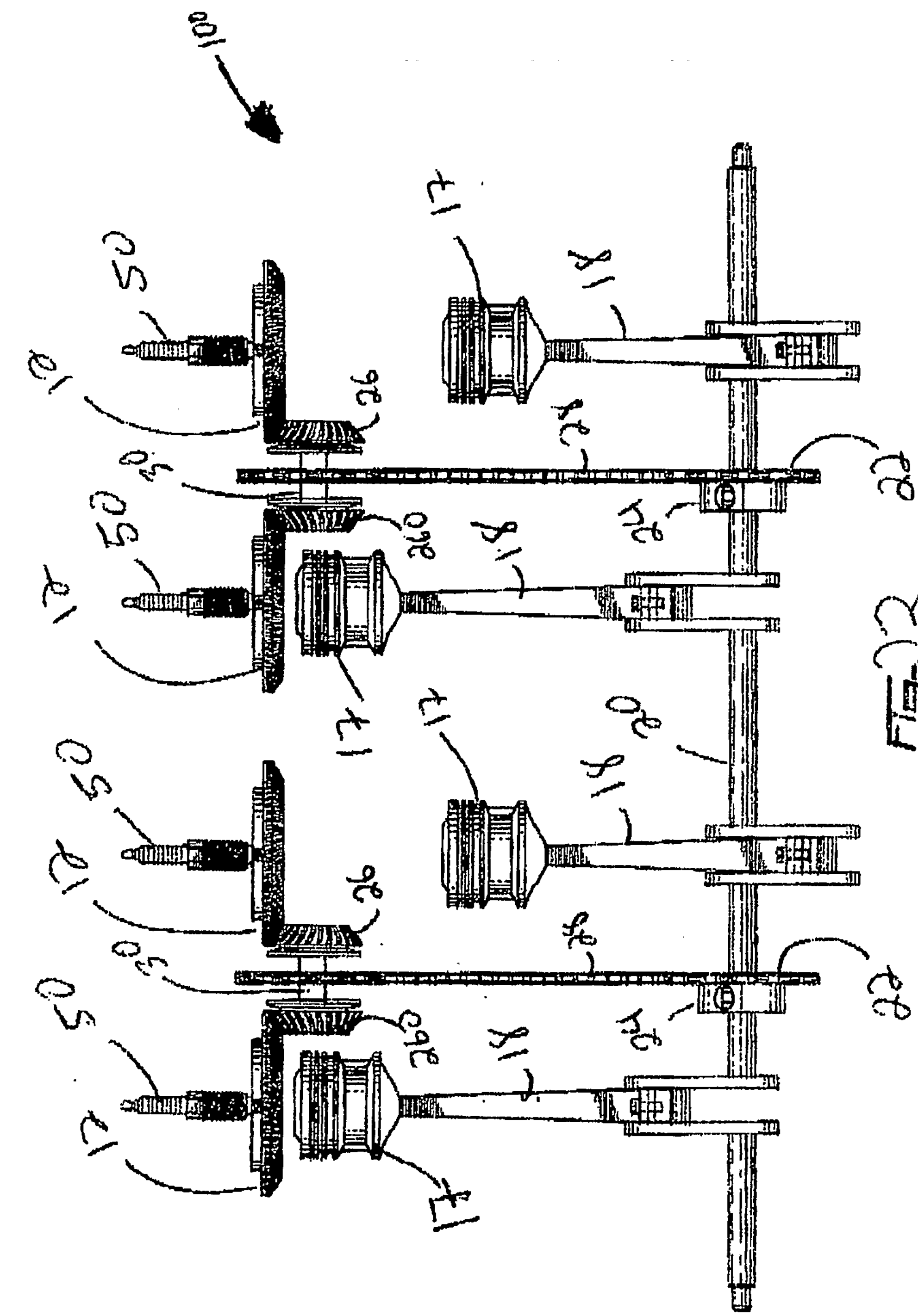


FIG. 3